Using granite landforms to decrypt soil erosion variations over millennia with in-situ 10Be and 239+240Pu

Raab, Gerald ; Scarciglia, Fabio ; Norton, Kevin ; Dahms, Dennis ; Brandová, Dagmar ; de Castro Portes, Raquel ; Christl, Marcus ; Ketterer, Michael ; Ruppli, Annina ; Egli, Markus

Geophysical Research Abstracts
Vol. 20, EGU2018-1264-1, 2018
EGU General Assembly 2018

Using granite landforms to decrypt soil erosion variations over millennia with in-situ 10Be and 239+240Pu

Gerald Raab (1), Fabio Scarciglia (2), Kevin Norton (3), Dennis Dahms (4), Dagmar Brandová (1), Raquel de Castro Portes (1), Marcus Christl (5), Michael E. Ketterer (6), Annina Ruppli (1), and Markus Egli (1)

(1) Department of Geography, University of Zurich, Winterthurerstrasse 190, 8057 Zurich, Switzerland, (2) Department of Biology, Ecology and Earth Sciences (DiBEST), University of Calabria, Via P. Bucci – Cubo 15B, 87036 Arcavacata di Rende (CS), Italy, (3) School of Earth and Environment, Victoria University of Wellington, PO Box 600, 6140 Wellington, New Zealand, (4) Department of Geography, University of Northern Iowa, Cedar Falls, USA, (5) Department of Physics, ETH Zürich, Otto-Stern-Weg 5, 8093 Zürich, Switzerland, (6) Chemistry and Biochemistry, Northern Arizona University, Box 5698, Flagstagg, AZ 86011-5698, USA

Landscapes and soils are shaped by changing environmental conditions and evolve in non-linear and complex ways. Many studies have tried to derive a chronology of process rates by comparing erosion rates over different time periods. However, capturing the full variability over a continues time-line remains a key challenge, because the often used catchment-wide approaches lack in distinction of erosion, as a general landscape process, from soil erosion.

Intensive erosion and denudation of gentle landscapes may lead to the exhumation of tors and formation of 'bornhardt' landforms, i.e. monolithic, tower-like or dome-shaped erosion resistant rocks. Soil erosion might be deducible over several time periods by determining the exhumation speed of such residual monoliths. Tor and boulder fields of the Sila Massif mountain plateau in Calabria (Italy) served as a test site with important results. The multi-method approach by using cosmogenic nuclides (10Be) along vertical tor profiles, coupled with fallout radionuclides (239+240Pu) in soils and numerical modelling, gave new insight into processes during the Pleisto- and Holocene. Regressive (soil formation < soil erosion) and progressive (soil formation > soil erosion) phases over the last 100 ka were deciphered in a relatively high time resolution. The application of a combination of different isotopes on the investigated archives enables quantifying soil erosion fluxes over millennia.